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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/065,678	11/07/2002	Mao-Ching Chiu	JCLA9038	9296

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EXAMINER	
DSOUZA, JOSEPH FRANCIS A	
ART UNIT	PAPER NUMBER
2637	

DATE MAILED: 02/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/065,678	CHIU ET AL.	
	Examiner	Art Unit	
	Adolf DSouza	2637	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 November 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Claim Objections

1. Claims 1-3 and 5 are objected to because of the following informalities:

Several words do not have a space between them, e.g. in claim 1, the phrase "and determine" appears as "anddetermine".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 3, 4, 13 and 17 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Regarding claims 3 and 13, the specification simply states that the timing tracking process uses the interpolated digital signal, the detected data or a pilot signal. No detailed description is provided of how any of these are used to obtain the timing information.

Regarding claim 4, the specification simply states that the timing tracking process uses the channel impulse response. No details, of how the channel impulse response is used in the timing tracking process, are provided.

Regarding claim 17, the specification does not provide any details of how interpolator divides the sampling clock interval into a number of sub-intervals and how the closest interpolation point is selected from the sub-intervals.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-13, 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miller (US 4,453,259) in view of Funderburk et al. (Asynchronous timing recovery for passband PS-FSE for single-chip V.32 modems; IEEE GLOBECOM 1993; 29 Nov.-2 Dec. 1993; pages 614 – 620).

Regarding claim 1, Miller discloses a method for recovering digital data content in a communication system (Fig. 1; column 4, lines 10-15):

wherein the digital data content has been converted into an analog signal for transmitting from a transmitter to a receiver through a communication channel (Fig. 1;

Fig. 2, element 26; column 4, lines 10-29; column 4, lines 44-47; wherein the analog signal is interpreted as the input signal 26 that is applied to the analog-to-digital converter 28);

the method comprising: receiving the analog signal by the receiver (Fig. 2, element 26 and 28);

converting the analog signal into a sampled digital signal, based on a local sampling clock (Fig. 2, elements 28 and 42; column 4, lines 44-54);

performing a interpolation process to interpolate the sampled digital signal at an interpolation point for generating an interpolated digital signal (Fig. 3, element 56; column 4, lines 55-65);

performing a timing tracking process to determine the interpolation point where the interpolation is to be taken at (Fig. 2, element 58; column 4, lines 55-65; wherein the timing tracking process is interpreted as the timing and control circuit) and determine whether or not the interpolation point is changed and different from the previous determined interpolation point (Fig. 3, element 86; column 5, lines 27-37; wherein determining if the interpolation point has changed is interpreted as incrementing or decrementing the up-down counter 86);

Miller does not disclose obtaining the channel impulse response and using the interpolated signal and channel impulse response to detect the digital data.

In the same field of endeavor, however, Funderburk discloses:

estimating a channel impulse response described by a set of coefficients based on the interpolated digital signal when the interpolation point is changed (page 616, 1st column, paragraph (iii); Fig. 4; wherein the estimating the channel impulse response is interpreted as being the same as being used for obtaining the equalizer tap gains and based on the interpolated signal is being interpreted as the output of the interpolation filter being fed into the passband PS-FSE);

and detecting the digital data content from the interpolated digital signal and the estimated coefficients of channel impulse response (Fig. 3;Fig. 4; wherein the detected data from the interpolated signal and channel impulse response is interpreted as the interpolation filter and passband PS-FSE being run before the Trellis decoder).

Therefore it would be obvious to one of ordinary skill in the art, at the time the invention was made, to use the method, as taught by Funderburk, in the system of Miller because this would enable the equalizer coefficients to be computed from the channel impulse response, thereby allowing the interpolated data signal to be equalized and enabling data detection.

Regarding claim 2, Miller discloses an initialization process to produce an initial condition, wherein the initial condition includes initial filter coefficients used in the interpolation process (column 5, lines 54-68; Fig. 5; wherein the initial filter coefficients used in the interpolation process are interpreted as those provided by the ROM 110).

Miller does not disclose an initial set of coefficients for the channel impulse response.

In the same field of endeavor, however, Funderburk discloses an initialization process to produce an initial condition, wherein the initial condition includes an initial set of coefficients of channel impulse response (page 616, 1st column, paragraph (iii); wherein the initial set of conditions for the channel impulse response is interpreted as being equivalent to the initial set of equalizer coefficients, since one can be derived from the other).

Therefore it would be obvious to one of ordinary skill in the art, at the time the invention was made, to use the method, as taught by Funderburk, in the system of Miller because this would enable the equalizer coefficients to be computed from the channel impulse response, thereby allowing the interpolated data signal to be equalized and enabling data detection.

Regarding claim 3, Miller discloses the timing tracking process is operated, according to the interpolated digital signal, the detected digital data content, or a pilot signal containing timing information for determining the interpolation point (column 5, lines 10-18; Fig. 3; wherein the timing tracking process operating on the detected digital data content is interpreted as the feedback 70 from element 66a to the timing and control circuit 58).

Regarding claim 4, Miller doe not disclose that the timing tracking process uses the channel impulse response.

In the same field of endeavor, however, Funderburk discloses the timing tracking process is performed with the information of the estimated channel impulse response (page 614, abstract, line starting with " An algorithm for timing error ∴"; page 615, section III, 1st paragraph; page 616, 1st column, paragraph (iii); page 617, 2nd column, paragraph starting with "It is to be recalled.."; wherein the information of the channel impulse response is being interpreted as being used to compute the equalizer response).

Therefore it would be obvious to one of ordinary skill in the art, at the time the invention was made, to use the method, as taught by Funderburk, in the system of Miller because this would enable the equalizer coefficients to be computed from the channel impulse response, thereby allowing the interpolated data signal to be equalized and enabling data detection.

Regarding claim 5, Miller discloses an update process if the interpolation point has been changed, wherein the update process comprises updating the filter coefficients used in the interpolation process according to the interpolation point (column 5, lines 54 – 68; wherein the updating the filter coefficients is interpreted as the ROM providing

coefficient values to the multipliers when there is a change in the contents of the up-down counter).

Miller does not disclose updating the set of coefficients of the channel impulse response.

In the same field of endeavor, however, Funderburk discloses performing a retraining process to update the set of coefficients of the channel impulse response, according to the interpolated digital signal (page 615, 1st column, 2nd paragraph; wherein the retraining process to update the set of coefficients of the channel impulse response is interpreted as using the LMS algorithm for adaptation of the equalizer coefficients, since the equalizer coefficients can be obtained from the channel impulse response).

Therefore it would be obvious to one of ordinary skill in the art, at the time the invention was made, to use the method, as taught by Funderburk, in the system of Miller because as the interpolation point changed, this would enable the equalizer coefficients to be computed from the channel impulse response, thereby allowing for equalization and data recovery.

Regarding claim 6, Miller does not disclose pausing the timing tracking process when retraining.

In the same field of endeavor, however, Funderburk discloses that while performing the retraining process, the timing tracking process optionally is temporarily paused (page 615, 1st column, line 9 – 17; wherein the retraining process is interpreted as the 200 symbol interval when timing control is not attempted).

Therefore it would be obvious to one of ordinary skill in the art, at the time the invention was made, to use the method, as taught by Funderburk, in the system of Miller because there is negligible timing phase change in the short training period and also the fractional spaced equalizer could compensate for any phase change in that short interval.

Regarding claim 7, Miller does not disclose the timing tracking is restarted when the retraining process is finished.

In the same field of endeavor, however, Funderburk discloses that the timing tracking process is awakened when the retraining process accomplishes (page 616, 1st column, paragraph starting with "The basis of our algorithm.." – paragraph ending "...aspect of our timing algorithm"; wherein the timing tracking awakened is interpreted as the time after the training period and the retraining process accomplishes is interpreted as the training period ending).

Therefore it would be obvious to one of ordinary skill in the art, at the time the invention was made, to use the method, as taught by Funderburk, in the system of Miller because this would enable continuous tracking of the clock drift after the training period.

As to claims 8-13, claims 8-13 are apparatus claims corresponding to method claims 1,2,6,7,4 and 3 respectively and recite substantially very similar limitations and are therefore similarly analyzed as method claims 1,2,6,7,4 and 3.

Regarding claim 15, Miller discloses the interpolation unit includes a digital filter with finite-length filter coefficients (column 5, lines 54-68; wherein the finite length filter coefficients are interpreted as the four coefficients used).

Regarding claim 16, Miller discloses that the number of the filter coefficients is two (column 5, lines 22-26; Fig. 4).

Regarding claim 17, Miller discloses a time interval between two adjacent sampling clock points are evenly divided into a number of sub-time intervals, so that a set of time points is formed, the timing tracking unit tracks an actual interpolation point, chooses the one of the set of the time points closet to the actual interpolation point, and outputs the chosen time point as the interpolation point to the interpolation unit (column 6, lines 9-47; wherein the sub-intervals are the N sub-intervals and the point chosen is the output of the interpolation filter y.sub.m.).

6. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miller (US 4,453,259) in view of Funderburk et al. (Asynchronous timing recovery for passband PS-FSE for single-chip V.32 modems; Funderburk, D.M.; McLane, P.J.; Park, S.; IEEE GLOBECOM 1993; 29 Nov.-2 Dec. 1993; pages 614 – 620) and further in view of Lee et al. (Digital Communication; 1988, Kluwer Academic Publishers, pages 14-15).

Regarding claim 14, Miller is silent on the ADC having a sampling rate larger than the Nyquist rate.

In the same field of endeavor, however, Lee discloses that the ADC has a sampling rate larger than and close to a Nyquist rate of the received analog signal (page 15, Exercise 2-7).

Therefore it would be obvious to one of ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lee, in the system of Miller because this enable the analog signal to be reconstructed from its samples for interpolation purposes.

Other Prior Art Cited

The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The following patents are cited to further show the state of the art with respect to using training sequences for channel estimation in wireless systems:

Lu et al. (US 6,128,357) discloses data receiver having variable rate symbol timing recovery with non-synchronized sampling.

Gatherer (US 6,154,497) discloses use of an interpolator in the timing adjustment of the sampling clock of an analog-digital converter.

Spurbeck (US 5,696,639) discloses a use of an interpolation filter in a clock recovery system.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Adolf DSouza whose telephone number is 571-272-1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Examiner
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AD

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